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# Space environment (natural and artificial) — Method of the solar energetic protons fluences and peak fluxes determination

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TECHNICAL REPORT

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# Space environment (natural and artificial) — Method of the solar energetic protons fluences and peak fluxes determination

*Environnement spatial (naturel et artificiel) — Méthode des fluences de protons énergétiques solaires et détermination des flux de pic*



Reference number
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# Foreword

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The committee responsible for this document is ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.


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# Space environment (natural and artificial) — Method of the solar energetic protons fluences and peak fluxes determination

## 1 Scope

This Technical Report is intended for calculating the probability for solar energetic particle (SEP) to have an impact on materials, hardware, and biological objects.

This Technical Report establishes the differential energy spectra for the $(0,1/10^3)$ MeV SEP fluences and/or peak fluxes in the near-earth space, beyond the earth magnetosphere during the missions any duration under varying solar activity.

If additional prepositions are used, the method establishes the basic fluences and peak fluxes for their determination throughout the heliosphere. When the effect of the particle penetration into the magnetosphere is taken into account (see ISO/AWI 17520, *Cosmic ray and solar energetic particle penetration inside the magnetosphere: Determination of the vertical cutoff values*, draft standard), the method establishes the basic fluences and peak fluxes for their determination on the near-earth spacecraft and manned station orbits.

Because the occurrence of SEP is a process a probabilistic nature, fluences and peak fluxes calculation relate to the different levels of probability.

The method is intended for specialists engaged in determination of radiation conditions in space.

## 2 Definitions, notations, and abbreviations

| Term | Notation | Abbreviation | Definition |
|---|---|---|---|
| Solar energetic particles (or solar cosmic rays) | | SEP | High-energy (≥4 MeV/nucl) charged particle of solar origin. |
| Mission duration | $T$ | | Calendar time period for the SEP peak flux or fluence is model calculated (months). |
| Wolf (sunspot) number | $W$ | | $W = k(10g+f)$, where $g$ is sunspot group number; $f$ is the total sunspot number on the visible solar disc. $k$ is the coefficient adjusting various observation conditions. |
| Solar activity (SA) level | $<W>$ | | 13-month smoothed month sunspot number or predicted by NOAA month sunspot number. <http://www.sec.noaa.gov/Data/> |
| Solar activity condition | $\Sigma <W_i>$ | | The sum of the smoothed month sunspot numbers during the space mission |
| Mission parameter | $n$ | | The parameter of the model, relative determined as the hypothetic mean number of SEP events with the fluences $F_{30} \geq 10^5$ cm$^{-2}$ protons with energy ≥30 MeV expected during the missions duration. |
| Particle energy | $E$ | | Particle energy (MeV/nucleon). |
| Particle fluence | $F$ | | The total (time-integrated) number of particles in given space mission that traverse a unit area from all directions from solid angle 4π (particle/cm$^2$). |

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